

WHERE DIFFERENT SERVO SYSTEMS EXCEL		Brush dc servomotor (PMDC motor)	Brushless dc servomotor (synchronous motor)	PM ac servomotor (synchronous motor)	Induction ac servo (asynchronous motor)
Motor type (typical identification)		Brush dc	Brushless dc (BLDC) — 1 ϕ of 3 ϕ is always off	3 ϕ	3 ϕ
Drive amplifier type (technology method delivering power)		PWM • SCR • linear	PWM	PWM	PWM
Commutation type		Mechanical	Electrical	Electrical	Electrical
Commutation (typical identification)		commutator	Six-step trapezoidal	PWM sinewave	PWM sinewave
Commutation control or electrical sensing type		rotating switch	Hall sensors or comcoder*	Position sensor**	Position sensor
Control type availability	Torque control (typical) — current-loop feedback • external or via power module (typical)	✓	✓	✓	✓
	Velocity control — velocity-loop feedback • digital feedback • displacement per sample-of-time — typically replacing analog — tachometer***	✓	✓	✓	✓
	Position control — position-loop feedback (typical) Digital resolution — counts per displacement	✓	✓	✓	✓
Feedback possibilities (typical)	Resolver • analog — converted to digital	✓	✓	✓	✓
	Sine encoder • analog/digital — optical	✓	✓	✓	✓
	Sine encoder • analog/digital — inductive	✓	✓	✓	✓
	Sine encoder • analog/digital — capacitive	✓	✓	✓	✓
	Encoder (TTL)	✓	✓	✓	✓
Capabilities	Highest torque density			✓	
	Largest torque and speed range			✓	
	Highest velocity (potential)		✓		✓
	Highest bandwidth response times			✓	
	Highest acceleration/deceleration			✓	
	Maintenance (lowest expected)			✓	✓
	Hold position (steadiest)	✓		✓	✓
	Position — precision capability (likely highest)			✓	
	Precise control of velocity (smooth speed operation)	✓	****	✓	*****
	Precise control of torque (tension etc.)	✓		✓	
	Rotor inertia (minimal for a given torque capability)		✓	✓	
	Rotor inertia — maximum for a given torque capability	✓		✓	✓
	Fastest corrections against disturbances and new commands			✓	
	Peak torques available — as for continuous capacity	✓	✓	✓	✓
	Highest resolution — sine encoder and could be used with any		✓	✓	
	Harshest environments — resolver feedback and could be used with any		✓	✓	
	Low input voltage — down to ~16 Vac or ~ 24 Vdc-bus	✓	✓	✓	
	High-input voltage — to 480 Vac		✓	✓	✓
	Highest efficiency			✓	
	Highest product throughput			✓	
	Highest precision (with high-resolution feedback)	*****		✓	
	Highest availability of mechanical options (as for mounting)			✓	
	Lowest cost (potential — present day)		✓		✓
	Easiest to customize (windings)			✓	
	Bidirectional capability	✓	✓	✓	✓